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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/759,078	01/20/2004	Mark E. Tuttle	M4065.0515/P515-A	7172

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EXAMINER

TUGBANG, ANTHONY D

ART UNIT	PAPER NUMBER
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3729

DATE MAILED: 07/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/759,078

Applicant(s)

TUTTLE, MARK E.

Examiner

A. Dexter Tugbang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 57-79 and 92-102 is/are pending in the application.
- 4a) Of the above claim(s) 73-79 and 92-102 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 57-72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/20/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of the invention of Group I, Claims 57-72 in the reply filed on June 26, 2006 is acknowledged.
2. Claims 73 through 79 and 92 through 102 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on June 26, 2006.

Priority

3. The specification (on page 1) does reference parent application no. 10/120,512. However, this reference does not include the current status of the parent application, i.e. that it matured in U.S. Patent 6,903,396. The reference should be amended to reflect the current status.

Drawings

4. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: A Method of Forming a Magnetic Tunnel Junction.

Claim Objections

6. Claim 67 is objected to under 37 CFR 1.75 as being a substantial duplicate of Claim 61. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 57 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Japanese Patent 11-68192, referred to hereinafter as JP'192, Lehrer 4,420,365 and Dunkleberger 4,256,816.

JP'192 discloses a method of forming a magnetic tunnel junction comprising: forming a first magnetic layer (e.g. 210 in Fig. 3); forming a first nonmagnetic layer (e.g. 350 in Figs. 3, 4

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or 6) in contact with the first magnetic layer; forming at least one opening (not labeled) in a portion of the first nonmagnetic layer to expose a portion of the first magnetic layer; forming a tunnel barrier layer (e.g. 310 or 311 in Figs. 4 or 6) within the opening in contact with the first magnetic layer; and forming a second magnetic layer (e.g. 211) over the tunnel barrier layer.

Regarding Claim(s) 58, JP'192 further shows that the first nonmagnetic layer (e.g. 350) is thicker than the tunnel barrier layer (e.g. 310 or 311), as shown in the cross-sectional view of Figure 6.

JP'192 does not mention that the opening in the first nonmagnetic layer is formed by removing a portion of the first nonmagnetic layer. It is noted that the opening in the first nonmagnetic layer JP'192 is utilized for subsequent formation and defining of the shape of the tunnel barrier layer.

Both Lehrer and Dunkelberger each show that it is conventional and notoriously well known in the art to remove a portion of a nonmagnetic layer to form an opening such that the opening forms and defines the shape of a subsequent barrier layer.

Lehrer shows a first nonmagnetic layer (e.g. 3) that is patterned by removing a portion of the first nonmagnetic layer to form an opening (e.g. 4) so that a subsequent barrier layer (e.g. 5 or 6) can be formed and shaped within the opening (col. 2, lines 46-51).

Dunkelberger also shows a first nonmagnetic layer (e.g. 12 in Fig. 5) that is patterned by removing a portion of the first nonmagnetic layer to form an opening (e.g. 19" in Fig. 6) so that a subsequent barrier layer (e.g. 20) can be formed and shaped with the opening.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of JP'192 by forming the opening in the first

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nonmagnetic layer by removing a portion of the first magnetic layer, as taught by Lehrer and Dunkelberger, to advantageously allow subsequent patterning of the tunnel barrier layer to a certain shape within the opening.

9. Claims 59 through 61, 63 through 69, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of JP'192, Lehrer and Dunkelberger, as applied to claims 57 and 58 above, and further in view of Gill 6,181,537.

JP'192, as modified by Lehrer and Dunkelberger, disclose the claimed manufacturing method as relied upon above in Claims 57 and 58 and further including the following.

Regarding Claim(s) 66, JP'192 further teaches that side edges of the second magnetic layer (e.g. 211) is formed over a top surface of the first nonmagnetic layer.

Regarding Claim(s) 72, JP'192 further teaches that the tunnel barrier layer (e.g. 311) has a top surface with projections (not labeled in Fig. 1) that appear to extend outside a portion of the opening.

The modified JP'192 method does not teach that the first magnetic layer is a pinned layer and that the second magnetic layer is a free layer (as required in Claims 59 and 60).

Gill shows a magnetic tunnel junction manufacturing process that includes forming a tunnel barrier layer (e.g. 225 in Fig. 11) where the first magnetic layer is a pinned layer (e.g. 215) and the second magnetic layer is a free layer (e.g. 235).

Regarding Claim(s) 61, 65 and 67, Gill further teaches that a thickness of the tunnel barrier layer 225 is 10 Angstroms and that the thickness of the free area is 235 is 20 Angstroms (col. 5, lines 40+). Thus, the tunnel barrier layer is formed to have a smaller surface area (along the thicknesses) than the free layer.

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Regarding Claim(s) 63, Gill further teaches that the tunnel barrier layer is aluminum oxide (col. 5, lines 52-54).

Regarding Claim(s) 68, 69, 71 and 72, Gill further teaches that the tunnel barrier layer is vertically centered with respect to the free layer, and is horizontally off-centered with respect to the free layer, and each have substantially the same shape (all of which is shown in Fig. 11).

It is noted that JP'192 and Gill each teach processes of forming the very same device, e.g. a magnetic tunnel junction. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the first and second magnetic layers of JP'192 by utilizing the magnetic tunnel junction manufacturing process of Gill, to positively form an art-recognized equivalent magnetic tunnel junction.

Regarding Claim(s) 64, it would have been an obvious matter of design choice to choose any desired thickness of the first nonmagnetic layer since the applicant(s) have not disclosed that the claimed thickness in the range of 20 to 300 Angstroms, solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with the thickness of the first nonmagnetic layer taught by JP'192.

10. Claim 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of JP'192, Lehrer and Dunkelberger, as applied to claims 57 and 58 above, and further in view of Reisman et al 5,201,995.

JP'192, as modified by Lehrer and Dunkelberger, disclose the claimed manufacturing method as relied upon above in Claims 57 and 58. The modified JP'192 method does not mention that the first nonmagnetic layer comprises aluminum oxide.

Reisman shows that it is conventional and known to have a first nonmagnetic layer (e.g. 11) comprise aluminum oxide (col. 7, lines 45-50) to perform the function of forming a subsequent barrier layer (e.g. 12) within an opening of the first nonmagnetic layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the first nonmagnetic layer of JP'192 by utilizing the material of aluminum oxide, as taught by Reisman, to perform the very same manufacturing step or function of forming a barrier layer with the opening of the first nonmagnetic layer.

11. Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of JP'192, Lehrer, Dunkelberger and Gill, as applied to Claims 57 through 60 above, and further in view of Abraham et al 6,452,764.

JP'192, as modified by Lehrer, Dunkelberger and Gill, disclose the claimed manufacturing process as relied upon above in Claims 57 through 60. The modified JP'192 method does not mention that the tunnel barrier layer is formed to have a different shape than the free layer.

Abraham shows a tunnel barrier layer (e.g. 422 in Fig. 12c) that is of a different shape than the free layer (e.g. 424). Both JP'192, Gill, and Abraham each disclose manufacturing methods to form the very same device, e.g. a magnetic tunnel junction. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the shape of the free layer to be different than the tunnel barrier layer, as taught by Abraham, to form an art-recognized equivalent tunnel junction.

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Conclusion

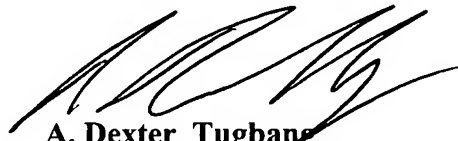
12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to A. Dexter Tugbang whose telephone number is 571-272-4570.

The examiner can normally be reached on Monday - Friday 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter Vo can be reached on 571-272-4690. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


A. Dexter Tugbang
Primary Examiner
Art Unit 3729

July 24, 2006